CLAIMS

1. A composite porous membrane comprising a hydrophobic substrate coated with difunctional surface-modifying molecules, each difunctional surface-modifying molecule comprising a hydrophobic portion associated with the substrate and a hydrophilic portion, wherein the surface-modifying molecules are crosslinked to form a crosslinked hydrophilic polymeric network at the surface of the membrane.

2. The membrane according to claim 1, wherein the hydrophilic portion of the surface-modifying molecules comprises at least two crosslinking active groups.

3. The membrane according to claim 2, wherein the crosslinking active group comprises a carbon-carbon double bond.

4. The membrane according to claim 1, wherein the difunctional surface-modifying molecules comprise difunctional acrylate molecules.

5. The membrane according to claim 1, wherein 100% of molecules associated with the substrate comprise difunctional surface-modifying molecules.

6. The membrane according to claim 1, wherein the hydrophobic group is a hydrophobic alkyl, aromatic group, or olefinic hydrocarbon group.

7. The membrane according to claim 1, wherein the hydrophobic group comprises an aromatic hydrocarbon molecule.

8. The membrane according to claim 7, wherein the aromatic hydrocarbon comprises a bisphenol A group.

9. The membrane according to claim 1, wherein the hydrophobic group does not form covalent bonds with the surface.

10. The membrane according to claim 1, wherein the hydrophilic group is positively charged.

11. The membrane according to claim 1, wherein the hydrophilic group is negatively charged.

12. The membrane according to claim 1, wherein the hydrophilic group comprises a neutral charge.

13. The membrane according to claim 1, wherein the hydrophilic group comprises the general formula $[-X_{n1}-Y-CR=CH_2]_{n2}$ where X is independently selected from the group consisting of (-CH2-CH2-O-); (-CH2-O-); (-CH2-CH(COOH)-); (-CH2-CH(OH)-); Y is selected from the group consisting of ($[-CH2-]_{n3}$); (-COO-); n_1 is from about 1-50; n_2 is from about 1-2; and n_3 can be from about 1 to about 50.

14. The membrane according to claim 1, wherein the difunctional surface modifying molecules are polymerized on the substrate surface after being preferentially adsorbed with the substrate surface.

15. The membrane according to claim 1, wherein the difunctional surface molecules comprise ethoxylated (30) bisphenol A diacrylates.

16. The membrane according to claim 1, wherein the photoinitiator is preferentially adsorbed by the substrate surface.

17. The membrane according to claim 1, wherein the photoinitiator comprises a substantially hydrophobic molecule.

18. The membrane according to claim 1, wherein the photoinitiator is selected from the group consisting of the photoinitiators shown in Figures 2A-2O.

19. The membrane according to claim 1, wherein the membrane has an average pore size of from about greater than 0 μm to about 10 μm.

20. The membrane according to claim 1, wherein the hydrophobic substrate comprises polyvinylidene fluoride.

21. The membrane according to claim 1, wherein the membrane is wettable within less than about 30 seconds after drying upon contacting with an aqueous solution.

22. The membrane according to claim 1, wherein the membrane is autoclavable.

23. A method for making a composite porous membrane with a hydrophilic surface, comprising:

a) providing a hydrophobic substrate;

b) coating the hydrophobic substrate with difunctional surface-modifying monomer molecules, wherein the difunctional surface-modifying molecules comprise a hydrophobic portion and a hydrophilic portion and wherein the surface-modifying molecules are associated with substrate via their hydrophobic portions; and

c) crosslinking the surface-modifying molecules to form a crosslinked hydrophilic polymer network on the surface of the substrate.

24. The method according to claim 21, wherein the coating is performed using a flow-through method.

25. The method according to claim 21, wherein the substrate is immersed the reagent bath comprising a solution of difunctional surface-modifying molecules and a photoinitiator, and wherein the solution is forced through the substrate.

26. The method according to claim 23, wherein the reagent bath further comprises a solvent.

27. The method according to claim 23 wherein the photoinitiator comprises a substantially hydrophobic molecule.

28. The method according to claim 23, wherein the photoinitiator is a molecule selected from the group consisting of photoinitiators shown in Figures 2A-2O.

29. The method according to the claim 23, wherein the membrane is exposed to actinic radiation for a sufficient period of time to polymerize the difunctional surface-modifying molecules on the substrate.

30. The method according to claim 23, wherein the hydrophilic portion of the surface-modifying molecules comprises at least two crosslinking active groups.

31. The method according to claim 30, wherein the at least one crosslinking active group comprises a carbon-carbon double bond.

32. The method according to claim 23, wherein the difunctional surface-modifying molecules comprise difunctional acrylate molecules.

33. The method according to claim 23, wherein 100% of molecules associated with the substrate comprise difunctional surface-modifying molecules.

34. The method according to claim 23, wherein the hydrophobic group is a hydrophobic alkyl, an aromatic group, or olefinic hydrocarbon group.

35. The method according to claim 23, wherein the hydrophobic group comprises an aromatic hydrocarbon molecule.

36. The method according to claim 35, wherein the aromatic hydrocarbon comprises a bisphenol A group.

37. The method according to claim 23, wherein the hydrophobic portion of the surface-modifying molecule does not form covalent bonds with the surface.

38. The method according to claim 23, wherein the hydrophilic group is positively charged.

39. The method according to claim 23, wherein the hydrophilic group is negatively charged.

40. The method according to claim 23, wherein the hydrophilic group comprises a neutral charge.

41. The method according to claim 23, wherein the hydrophilic group comprises the general formula $[-X_{n1}-Y-CR=CH_2]_{n2}$ where X is independently selected from the group consisting of (-CH2-CH2-O-); (-CH2-O-); (-CH2-CH(COOH)-); (-CH2-CH(OH)-); Y is selected from the group consisting of ($[-CH2-]_{n3}$); (-COO-); n_1 is from about 1-50; n_2 is from about 1-2; and n_3 can be from about 1 to about 50.

42. The method according to claim 23, wherein the difunctional surface modifying molecules are polymerized on the substrate surface after being preferentially adsorbed with the substrate surface.

43. The method according to claim 23, wherein the difunctional surface molecules comprise ethoxylated (30) bisphenol A diacrylates.

44. The method according to claim 23, wherein the membrane has an average pore size of from greater than about 0 μm to about 10 μm.

45. The method according to claim 23, wherein the hydrophobic substrate comprises polyvinylidene fluoride.

46. The method according to claim 23, wherein the membrane is wettable within less than about 30 seconds after drying upon contacting with an aqueous solution.

47. The method according to claim 23, wherein the membrane is autoclavable.